UNIVERSITY OF SASKATCHEWAN
MIDTERM EXAMINATION

EE 402.3 Microwave Engineering

Professor:	Dr. D. M. Klymyshyn	February 28, 2006
Time:	**80 minutes**	
Notes:	One page formula sheet is allowed.	
	Class data sheets are allowed.	
	All 3 questions are of equal value.	
	Assume all transmission lines are lossless.	

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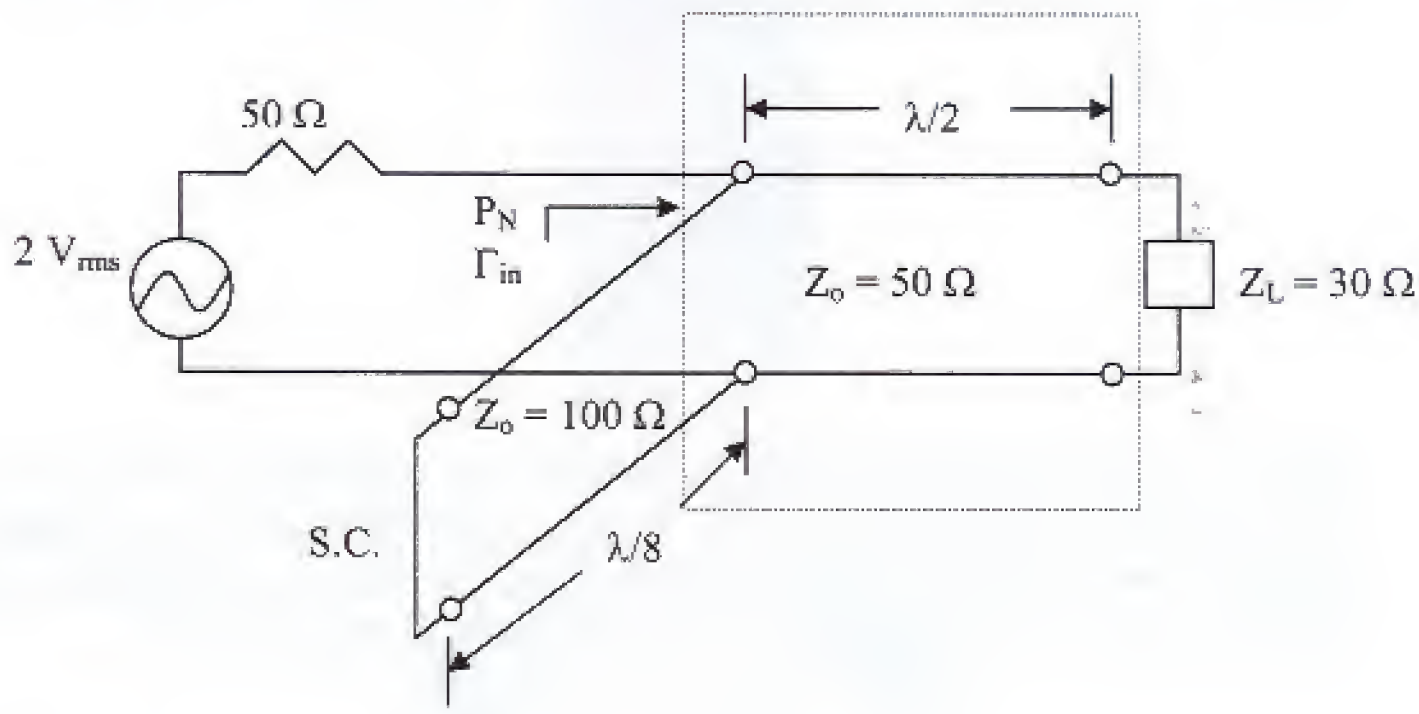
1. A microwave circuit is shown. Using **equations** (not the Smith Chart), find the following:

   a. [S] parameters measured in a 50 Ω system of the equivalent 2-port network highlighted in the dotted box (see Hints below).
   b. Power **available** from the source (P_{avs}).
   c. Power delivered to the **network** (P_N). Is $\Gamma_{in} = S_{11}$? Explain.



Hints:

ABCD of Shunt Admittance (Y)

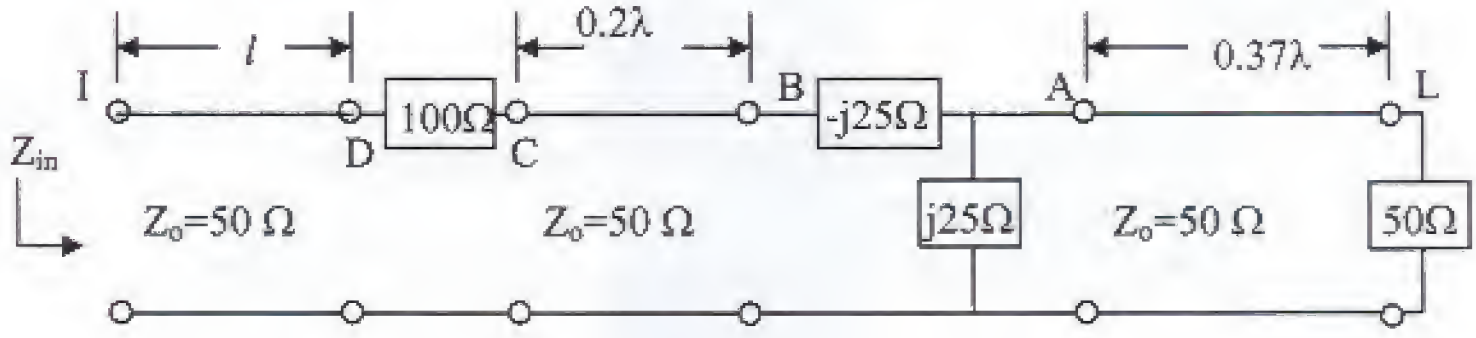
$$\begin{bmatrix} 1 & 0 \\ Y & 1 \end{bmatrix}$$

ABCD of Lossless Trans. Line (Z_o, β, l)

$$\begin{bmatrix} \cos\beta l & jZ_o \sin\beta l \\ jY_o \sin\beta l & \cos\beta l \end{bmatrix}$$

2. Use the **Combined Smith Chart** provided and determine the length, *l*, of transmission line required on the input to make the input impedance of the following circuit **purely real** and as **large as possible**. Include the Smith Chart with your solution, clearly marking the construction using the "letters" given in the circuit and "arrows" to indicate the direction of your transformations. (Note: shunt elements shown are impedances)

a. What is Z_{in} ?



3. Design an **open circuit single shunt** stub tuner to transform a 50 Ω load in a 50 Ω system to an impedance of $100 + j50$ Ω. The stub should be as **short as possible**. Use 50 Ω transmission lines for the tuner. Include the **Regular Smith Chart** provided with your solution, **clearly** marking all constructions.